FOLLOW THE GLIDER

DISCOVER THE OCEAN´S SECRETS WITH UNDERWATER GLIDERS

Albert Miralles

Glider pilot and engineer, SOCIB Glider Facility

amiralles@socib.es

MINISTERIO DE CIENCIA E INNOVACIÓN

CSIC CONSEJO SUPERIOR DE INVESTIGACIONES CIENTÍFICAS

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FOLLOW THE GLIDER

A DIGITAL EDUCATIONAL TOOL FOR TEACHERS AND

https://followtheglider.socib.es/

Follow the Glider web-based **educational tool** aimed at secondary school teachers and students to find out what underwater robots are and gain awareness of their importance for ocean research and conservation. In addition, "Follow the Glider" related outreach activities such as workshops are meant to engage a large audience and to bring knowledge on gliders to the teaching community.

39.892 web visits
15.036 users

SOCIB OUTREACH ACTIVITIES: 2015 -2021

16 Follow the glider workshops
541 participants
(students and general public)

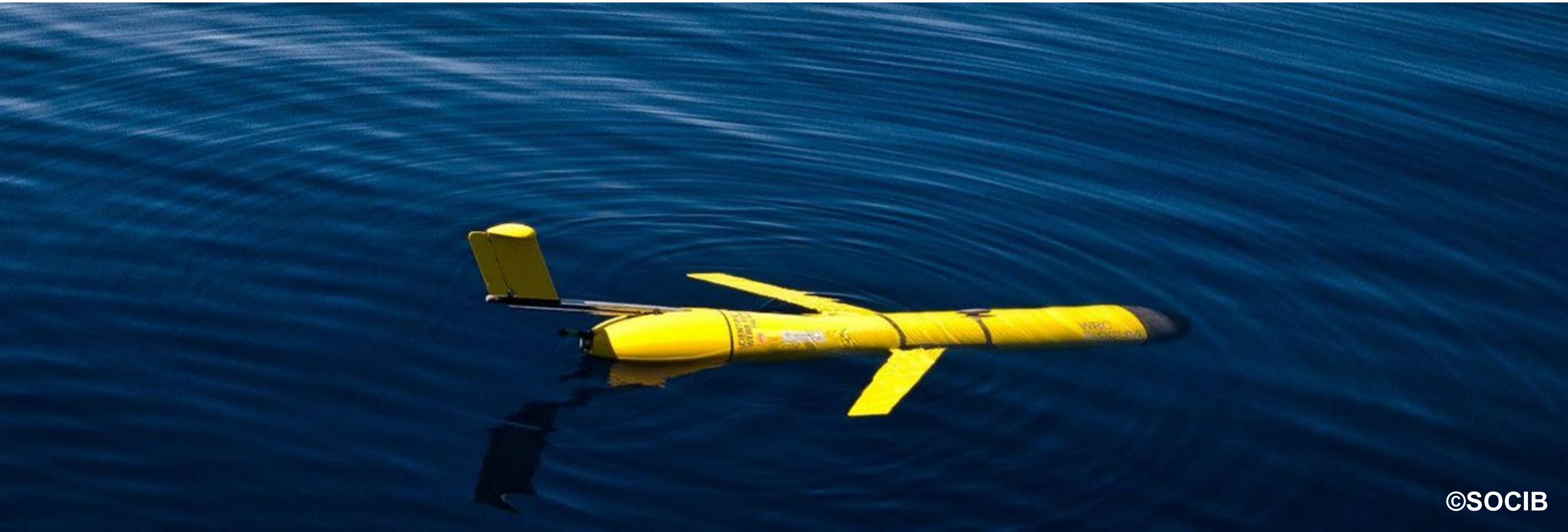
6 scientific fairs
23.832 participants
(students and general public)

1 workshop for teachers
117 teachers

WHAT IS A GLIDER

An underwater glider is a small submarine that's autonomous–which means there's nobody inside it, one reason being that nobody could fit in there: it's only about 2 meters long and weighs around 50 kilos. Underwater gliders are used to observe the seas and the oceans. Scientists place them in the water and the gliders collect interesting data about the temperature, the amount of salt and oxygen in the water, and so forth. They do so by using sensors that measure that information and much more depth, etc.)

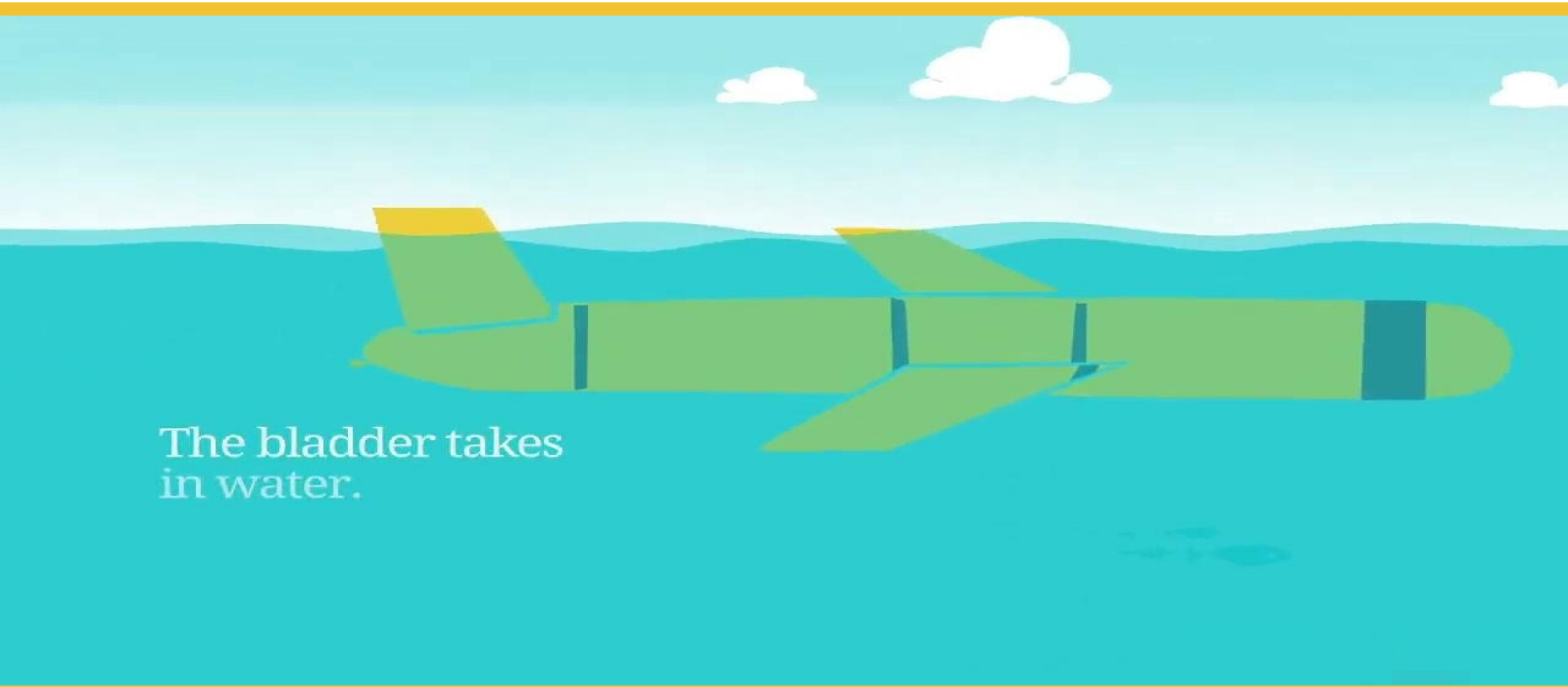
1. *They use very little energy because they glide; they don't have any motors or propellers.*
2. *They can dive as deep as 1000 meters*
3. *They can go as fast 10-20 cm/s in vertical motion, but if the currents help them along, they can go up to 1Km/h.*
4. *They can send data to the lab through their antennas, and receive data, too.*



THIS IS WHAT A GLIDER LOOKS

HOW IT WORKS?

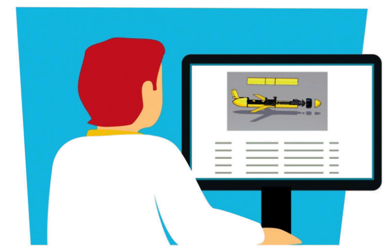
1. An underwater glider has a piston. When it wants to dive, it fills the piston up and sinks.
2. When it wants to come back up to the surface, it releases the water from the piston.
3. The space that held the water fills up with air, and that makes the glider rise.
4. It’s like an inflatable rubber ring: when it’s full of air, it floats, and when it isn’t, it sinks.



HOW IT WORKS?

1 Lab

The scientist decides on the glider's mission and the engineer, who is also the pilot, inputs the data into its operating system: route, the deepest dive, how often it will get in touch with the base, what data it will collect and how often, what information to transmit, etc.



2 Launching and navigating

Once we've put the glider in the water, first it sinks and then it ascends. During the entire mission, it keeps on going up and down like this. As it sinks and surfaces, it collects data. A set of alkaline or lithium batteries provide the power it needs to move.
It doesn't have propellers or a motor, so it doesn't use up a lot of energy. So we could ask, "How does it move along?" It does so by using its wings.

3 Data transmission

When the glider comes up to the surface, it connects its antenna, and sends the data it has collected via satellite. If necessary, it receives new orders. Its GPS helps it find its way, detects whether the currents have set it off course, and points it in the right direction.

How long do the batteries last?

A glider doesn't have a motor. It gets the power it needs from alkaline or lithium batteries and uses as little battery power as a mobile phone.

Battery life depends on…

- The type of battery: lithium batteries last longer.
- The environment: gliding against the current uses more power.
- The mission: if the glider has to dive deep, activate a large number of sensors, or send data many times a day, it uses more power.

What happens if it goes off course?

Ocean currents can set a glider off course. When it realises what's going on, the glider can correct its "mistake": for example, if it thinks there have been currents heading south, it will head further north to correct that divergence

End of the mission

- That was the way it was planned.
- Something very serious happens, like a mechanical failure.
- The batteries run out.
- If a storm is coming, we give the glider the order to dive down, avoid the storm, and wait until it passes to continue its mission. But if there's a long stretch of bad weather ahead we must get the glider back straight away!

Coming HOME

With any luck, the glider will get home on its own, but that may use a lot of battery power, so we have to work it all out well in advance, so the glider doesn't end up stranded.
Sometimes it's worth continuing to collect scientific data even if a glider's batteries have run out. In this case, when the power is all used up, we set out to find the glider, wherever it may be. This isn't always easy!

We've got a problem!

There are many dangers out there while a glider's on a mission:
If any of this happens, we must suspend the mission and rescue the glider!

- Mechanical or software failures.
- Collisions with boats, fishing nets, and buoys…
- Poor-quality batteries.
- Communications failures caused by the glider itself or by the satellites.
- Low-density waters that don't allow the glider to get back up to the surface.
- Unwanted fellow travellers, such as molluscs or remoras, that stick onto the glider and stop it from moving forwards.

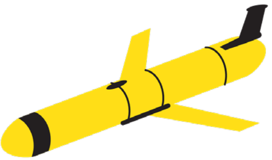
Pros and cons

There are other ways of getting data about the sea. One of them is organising an expedition with several scientists boarding a boat and sailing off for several days, weeks, or even months, to take all kinds of measurements. What are the advantages and disadvantages of using underwater gliders instead of other means, such as boats?

Advantages

- They work 24 hours a day, 7 days a week.
- They cover large distances.
- They can go on long-term missions.
- They're autonomous, unmanned systems, so you don't need a large number of people on board, as you would on a boat. Therefore, they're much cheaper!
- They can carry several different sensors which measure all kinds of
- data (temperature, salinity, chlorophyll, oxygen and even sounds!)
- They allow us to collect data practically in real-time.

DISADVANTAGES



- They move very slowly.
- They can only dive to 1,000 metres.
- They can't go any deeper!
- They can't take samples on the spot.
- They don't have an arm that can take sand or water samples, for example.
- They can only collect data!
- Their sensors are still quite low-resolution compared to the ones available on boats.
- The technology is very new. They're still in the prototype stage, so things don't always work properly.
- Watch out! Danger! They can run into fishing nets, plastic objects, or collide with the sea floor or boats.

WHAT DOES IT MEASURE?

An underwater glider measures different things in the seawater: some are physical (the amount of salt, the temperature) and others are biochemical (the amount of oxygen or chlorophyll in the water).

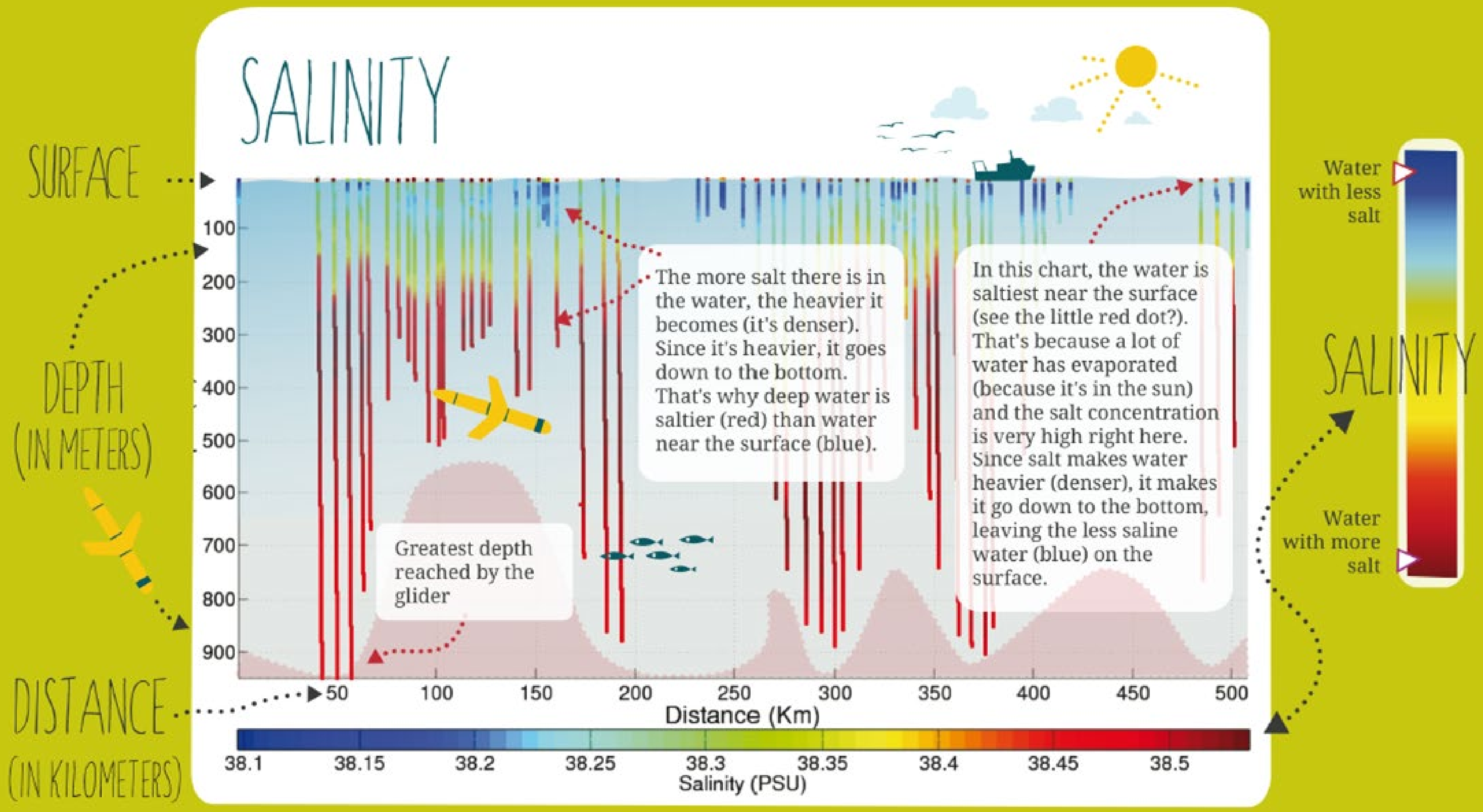
Physical parameters: salt and temperature

Seawater is not the same on the surface as in the depths. On the surface, it’s not very dense. Density depends on salt and temperature, among other things. So when we measure its temperature and salinity, we find out about the changes in the water’s density. These changes affect marine currents. If we have that information, we can find out more about how currents move.
We can also find out more about the weather’s influence on the sea.
For example, if it rains, the surface water cools down. If the weather’s very hot, the surface water warms up. This also has an effect on marine currents.

Biochemical parameters: oxygen and chlorophyll

The oxygen and chlorophyll in seawater are very important for marine ecosystems.
Oxygen is what most animals and plants need to survive. Chlorophyll helps us to know how much phytoplankton is in the water. Phytoplankton is small organisms (like tiny algae) that photosynthesise and contain chlorophyll. So, if there’s a lot of chlorophyll in the water, it means there’s lots of phytoplankton.
Do you think that’s important? Definitely, because so much marine life feeds on phytoplankton! Phytoplankton also absorb large amounts of C02, they’re like a forest in the sea, the “ocean’s lungs.”

How do we read the data we receiv



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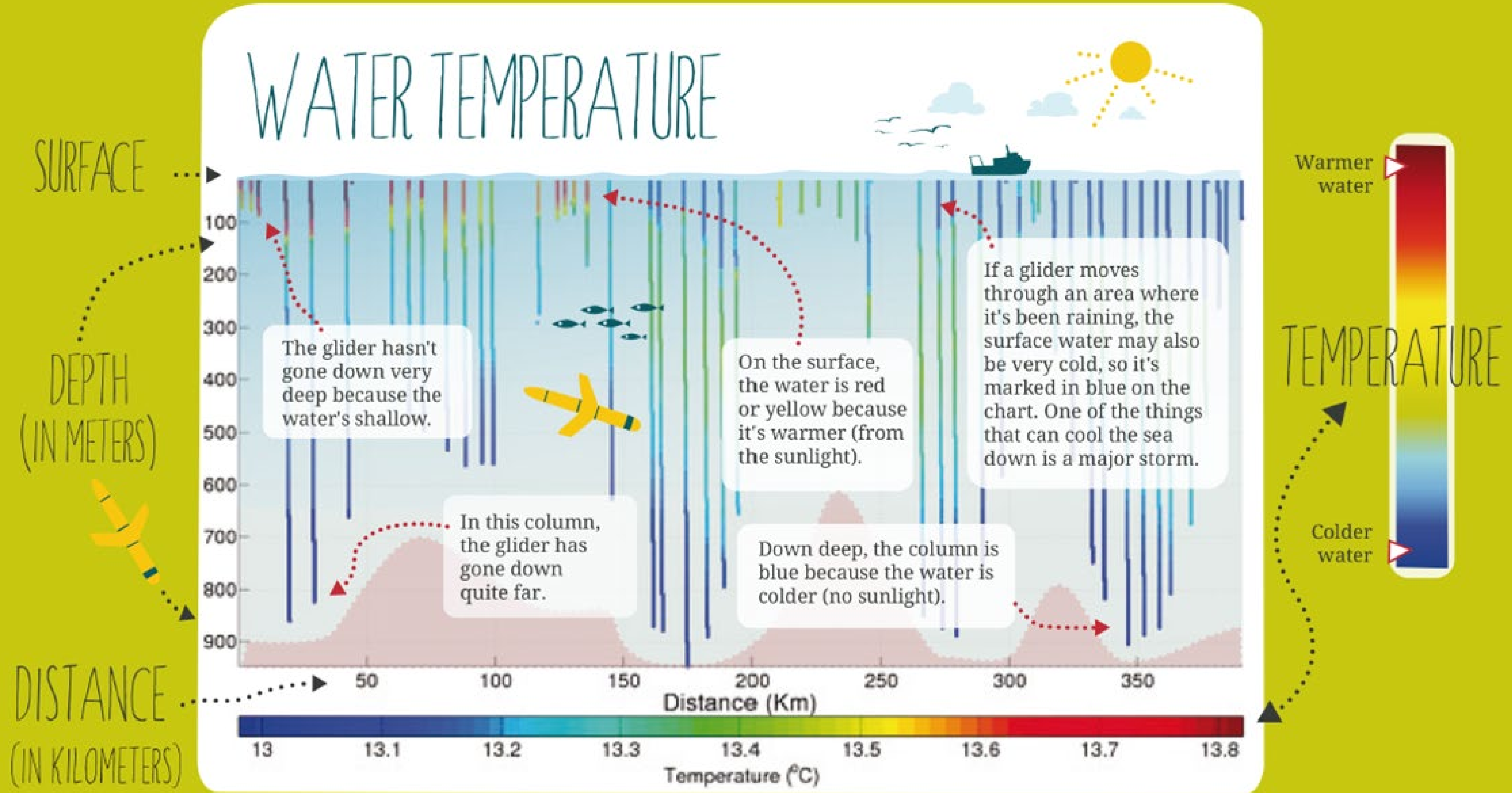

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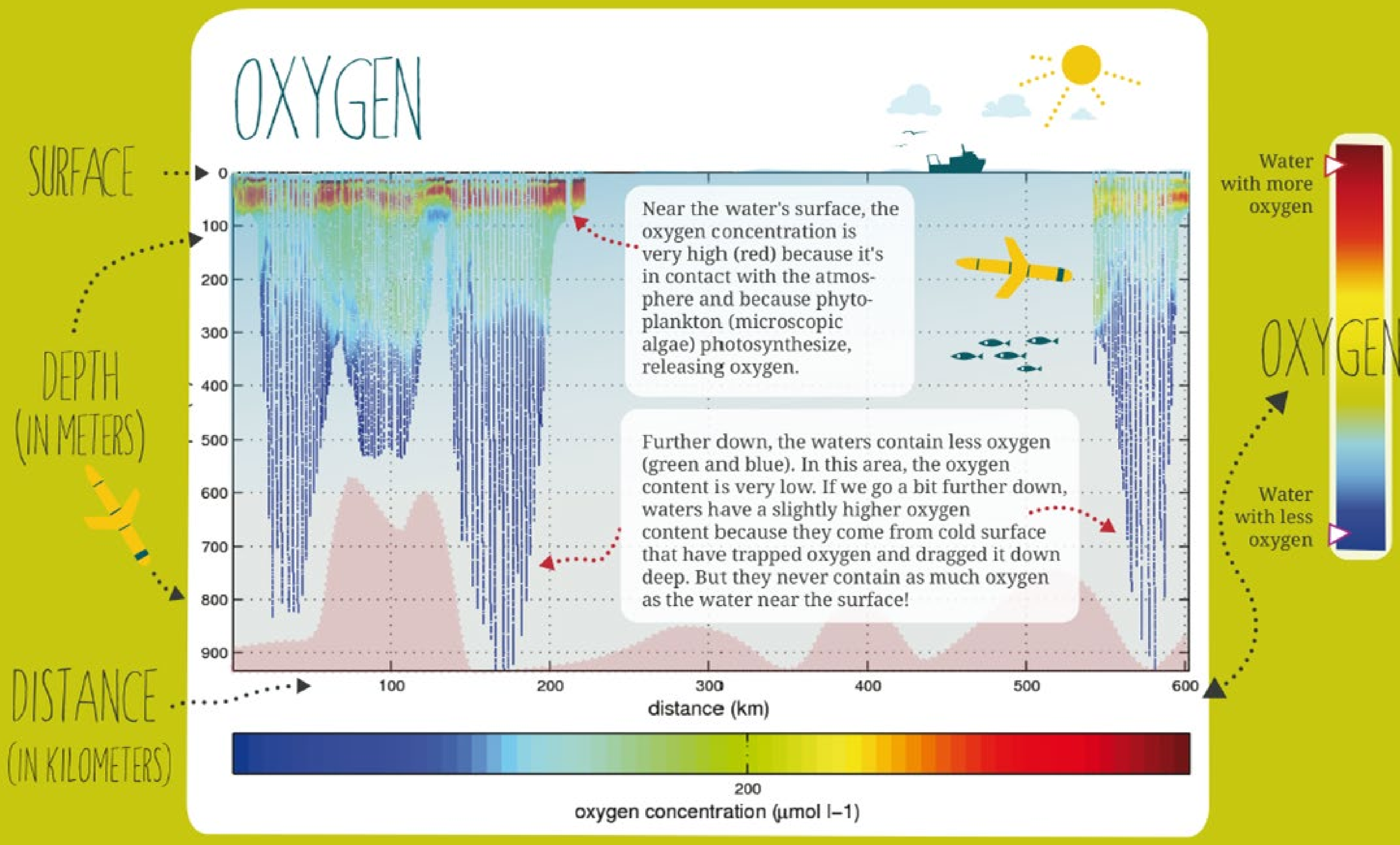

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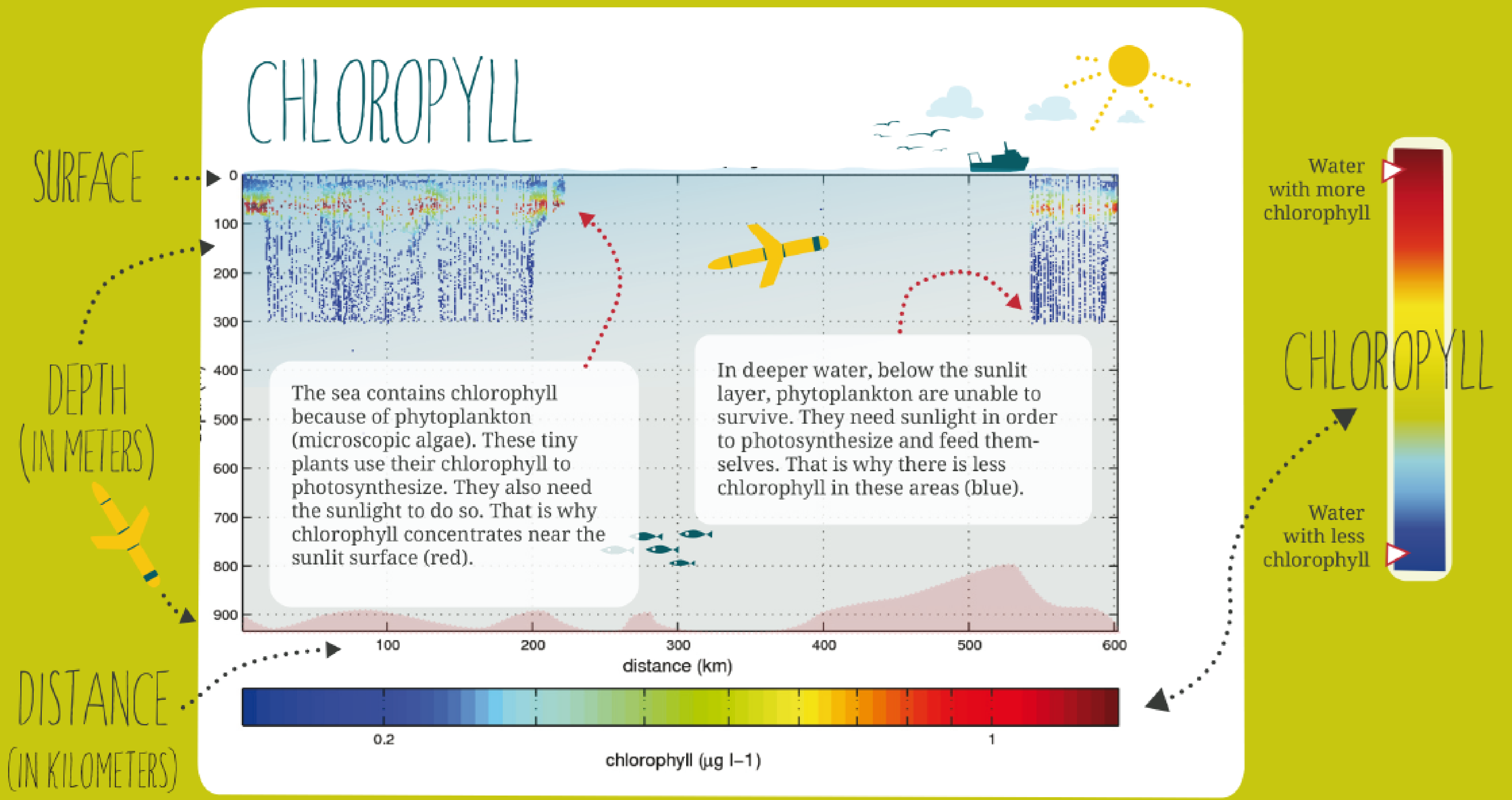


where are socib gliders sailing toda

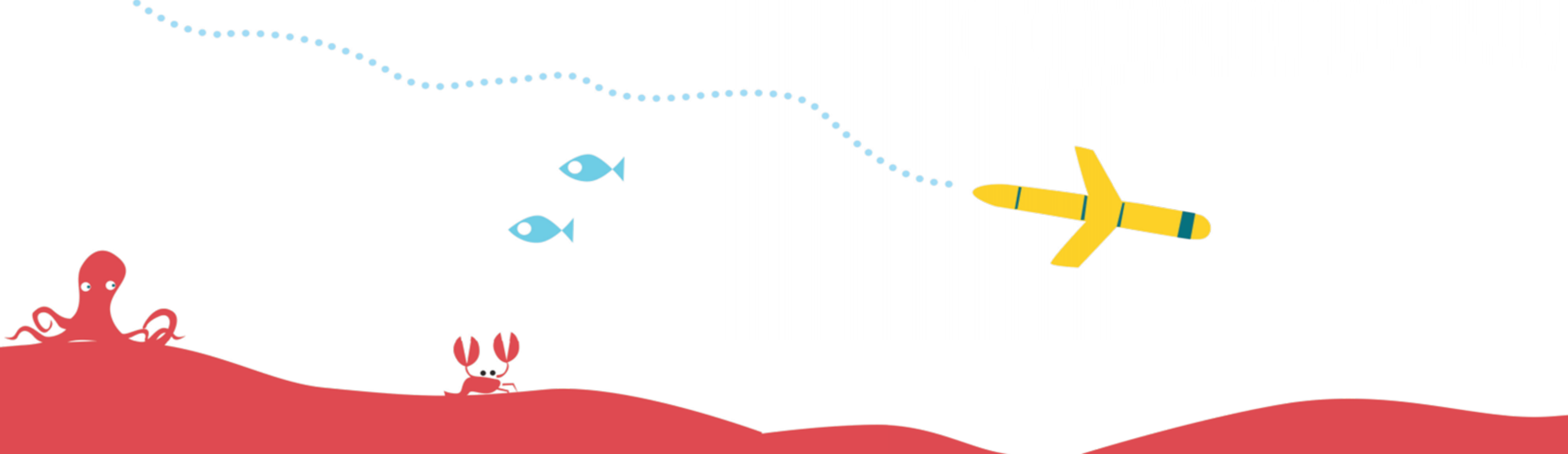
https://followtheglider.socib.es/

WHAT it is for?

We're used to seeing how weather works, with its high and low pressure areas, its storms and so on. Things are very similar in the sea, and it's important to know how currents and eddies work in order to come

up with forecasting models. These models enable us to do things such as:

- Know in what direction an **oil spill** is going to move. If we know where it's heading, we can try to contain it so that it does the least possible damage to the environment.
- Know how the ocean is reacting to **climate change**
- Know how **severe winter storms** affect the sea. These extreme phenomena can have an impact on marine ecosystems.
- In the future, gliders will have more advanced sensors that will allow us to measure nitrites, nitrates, pH, alkalinity, etc. This will allow us to take better care of our Marine Protected Areas, among other things.

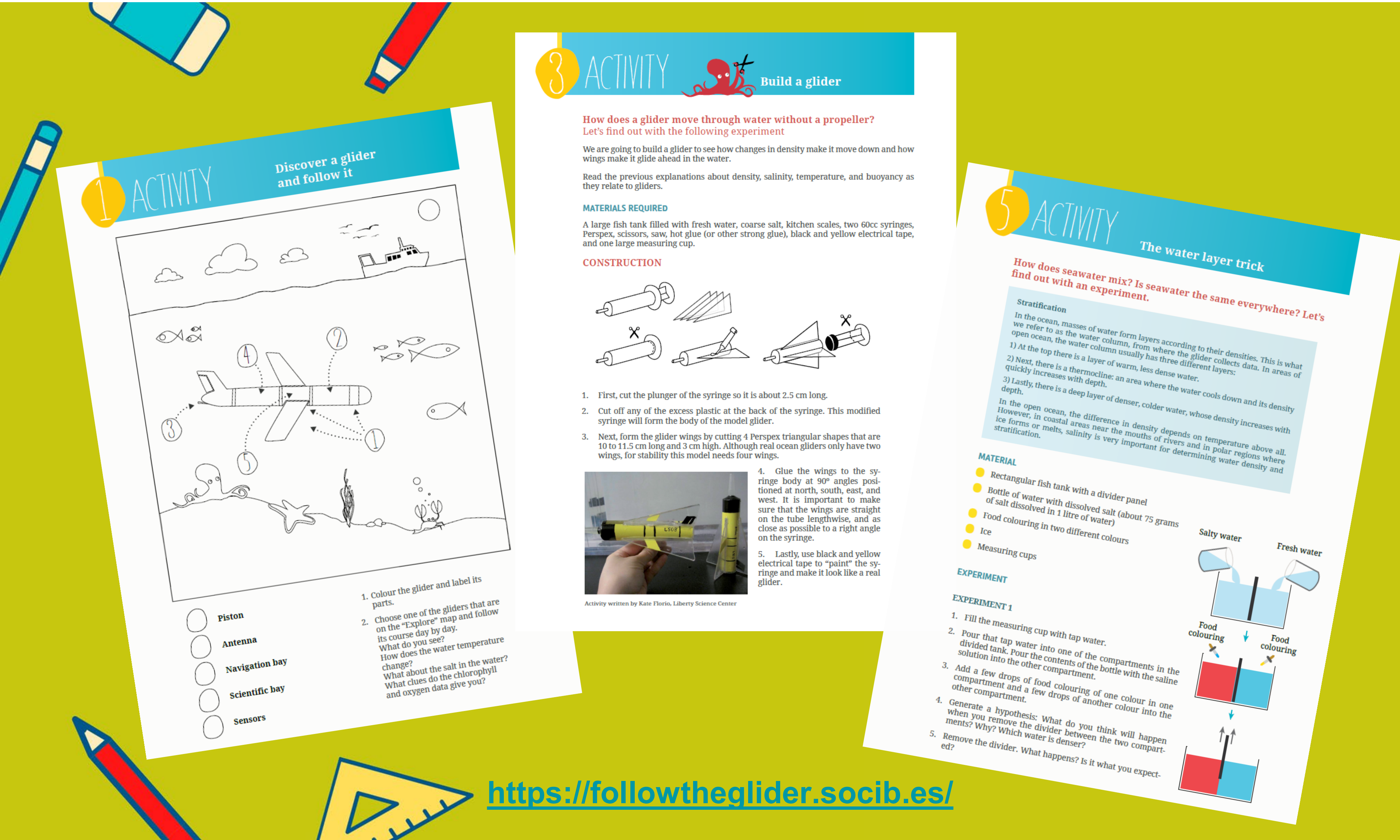


Educational resources

STUDENT BOOK & TEACHER'S GUIDE: ENGLISH

https://followtheglider.socib.es/

ACTIVITIES



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FOLLOW THE GLIDER

OCEAN OBSERVERS

¡Gracias!
Thanks!
Merci beaucoup!

Albert Miralles
Glider pilot and engineer, SOCIB Glider Facility
amiralles@socib.es

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